

Chapter 8

Assessment & Intervention: A Child With Lead Poisoning

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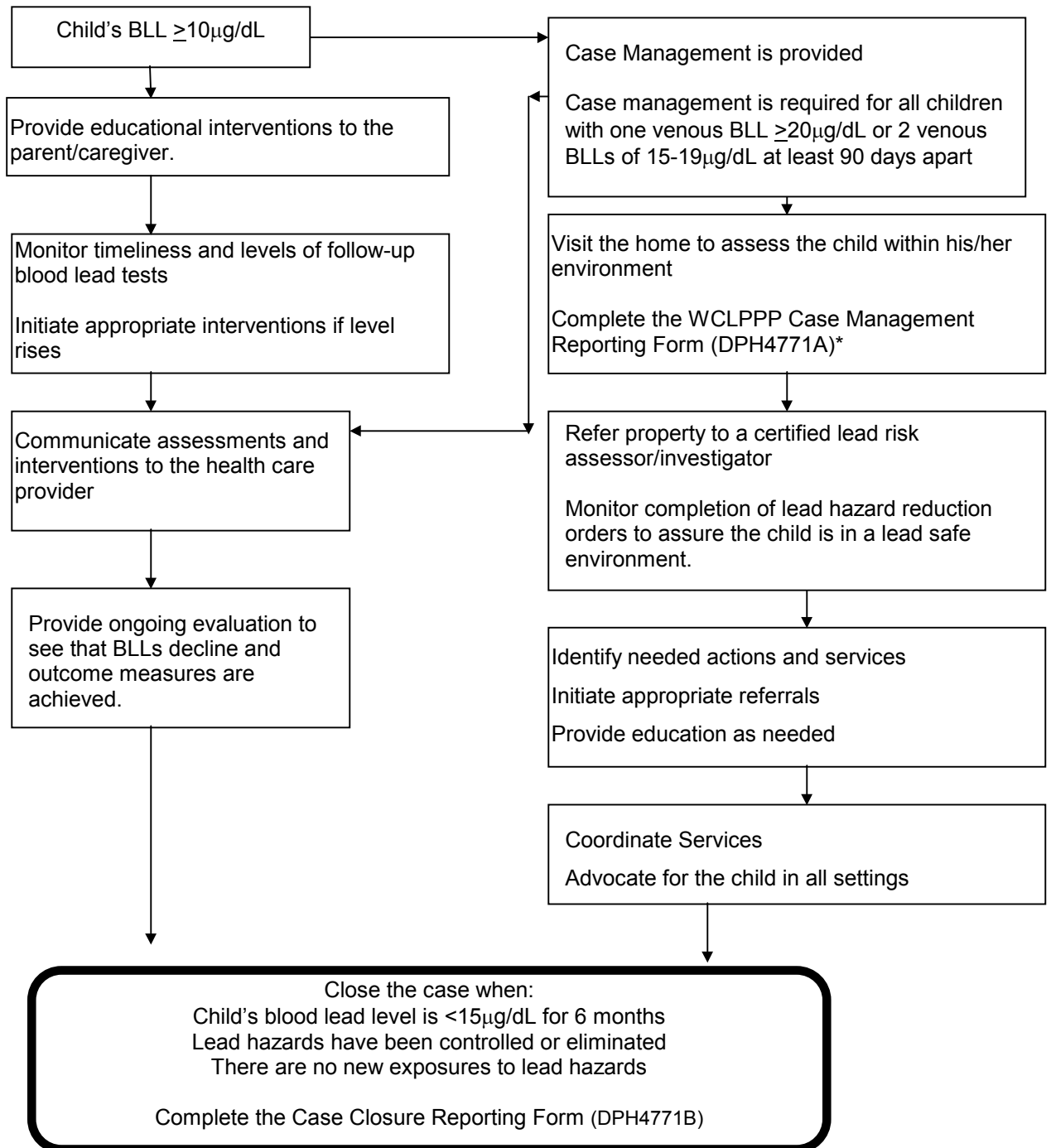
Summary of Standards for Assessment & Intervention of a Child with Lead Poisoning*

1. Contact families of all children with an elevated blood lead level (BLL) ≥ 10 $\mu\text{g/dL}$. (see Educational Interventions for Parents/Caregivers in this chapter). Provide information to assist the family in identifying possible sources of lead and steps to take to decrease exposure. Stress the importance of limiting the duration of exposure to lead hazards to prevent the BLL from going higher. Review the schedule for venous follow-up tests and where they can be done.
2. Provide case management services to all children with one venous BLL ≥ 20 $\mu\text{g/dL}$ or 2 venous BLLs ≥ 15 $\mu\text{g/dL}$ drawn at least 90 days apart, according to standards described in the Wisconsin Childhood Lead Poisoning Prevention Program (WCLPPP) Handbook for Local Health Departments.¹ The following activities are part of case management:
 - ✓ A visit to the home to assess the child within his/her environment. 2 visits are recommended.
 - ✓ A limited physical examination, health history, assess for iron deficiency anemia.
 - ✓ A developmental screening test (Chapter 12)
 - ✓ An assessment of diet and availability/access to food (Chapter 11)
 - ✓ Identification of risk factors for lead exposure.
 - ✓ Complete Case Report on Children with Elevated Blood Lead Levels (DPH 4771A) and return to WCLPPP.
3. Refer property(s) where the child resides and/or spends a frequent amount of time to a certified lead risk assessor investigation (WI Stat 254 requires a lead investigation of properties where a child with one venous BLL ≥ 20 $\mu\text{g/dL}$ or 2 venous BLLs ≥ 15 $\mu\text{g/dL}$ drawn at least 90 days apart resides.) Monitor the completion of lead hazard reduction measures to verify the child's exposure has been stopped.
4. Refer the family to a primary health care provider for medical management of lead poisoning (Chapter 9). Inform the provider of the schedule for follow-up venous BLLs, the need for long-term neurodevelopmental assessment, any other medical needs identified by assessment, and the results of nursing and environmental assessments provided for the child.
5. Identify and refer for needed services.
6. Advocate for the child in settings where necessary.
7. Coordinate the activities of the multi-disciplinary team in addressing the needs of the child and the child's environment.
8. Evaluate outcomes.
9. Close the case when the BLL has remained < 15 $\mu\text{g/dL}$ for six months AND lead hazards have been removed and there are no new exposures AND other objectives in the plan of care have been achieved. Submit Closure Report on Children with Elevated Blood Lead Levels (DPH 4771B) to WCLPPP.

*Adapted from the Centers for Disease Control & Prevention, "Managing Elevated Blood Lead Levels Among Young Children", March 2002

¹ Children with lower blood lead levels may benefit from case management services if social, cultural, and financial circumstances may influence recovery from lead poisoning.

FLOW CHART: ASSESSMENT & INTERVENTION FOR A CHILD WITH LEAD POISONING



Introduction

This chapter describes the range of nursing activities directed towards the child and family with lead poisoning. The most basic intervention that all children with a BLL $\geq 10\mu\text{g/dL}$ should receive is education. Information is provided to increase the knowledge of the parent/caregiver about lead poisoning, how to decrease exposure and prevent an increase in the child's BLL. **Case management** of a child with lead poisoning incorporates a focused and concentrated set of actions. While blood lead level alone does not always indicate the need for complex interventions, the higher the BLL the greater the diversity of services usually required. To receive funds from the WCLPPP, a health department is required to provide case management for all children with one venous BLL $\geq 20\mu\text{g/dL}$, or 2 venous BLLs $\geq 15\mu\text{g/dL}$ at least 90 days apart.

All children with lead poisoning (BLLs $\geq 10\mu\text{g/dL}$) may benefit from the interventions described as case management. The use of all or parts of these strategies for lead poisoned children depends on the complexity of the medical, nursing, social, environmental, and/or financial needs of the family that may influence the recovery from lead poisoning.

In most public health settings, it is the public health nurse (PHN) who plays a central role in assessing the child and assuring effective treatment of lead poisoning is provided. PHNs have unique training in case management: assessment, planning, and evaluation of individuals within the context of their physical and social environment. Nurses also have experiences in coordination of and communication among the multi-disciplinary team that works to assist the family to reduce the blood lead level of the child. The PHN either performs all the components of the assessment, planning, and evaluation, or may refer to other professionals and incorporate the results into the plan of care.

Treatment of childhood lead poisoning has many complicating factors. LHDs should contact the WCLPPP (608-266-5817) for consultation on cases whose circumstances do not conform to normal procedures and interventions, or when unfamiliar with chelation or other protocols.

Outcome Measures for Children With Lead Poisoning

The goal of all nursing activities is to provide optimal benefit for the child and the quickest recovery. Outcomes to measure progress toward this goal include:

1. The child's blood lead level is reduced
2. The child is living in a lead safe environment
3. The child with lead poisoning is achieving his/her optimal level of functioning
4. The parent/caregiver has adequate knowledge of prevention and management of lead toxicity, including how to identify learning/behavior needs as they develop or emerge.

The assessment and intervention strategies described in this chapter are directed towards the achievement of these goals by supporting specific outcome measures which can be used to evaluate the effectiveness of interventions. These outcomes are described further under “Evaluation of Care”.

Educational Interventions for Parents/Caregivers

For childhood lead poisoning, information is vital in preventing the disease, safeguarding children from exposure, and treatment (for more information on education strategies for target audiences related to preventing childhood lead poisoning, see Chapter 6). For most parents/caregivers, the risks of lead poisoning, the sources of lead, the impact of lead toxicity on young children, and the steps to prevent lead exposure are not well known.

Public health professionals are often the most knowledgeable resources within a community about childhood lead poisoning. Therefore, public health staff are designated as the primary source of information for families of children with a screening test of $\geq 10\mu\text{g/dL}$. WCLPPP reports all blood lead test results of children residing in a given area to the appropriate health department. It is the responsibility of the health department to contact the family and provide the following information:

- the blood lead test results and what the level means to their child
- sources of lead exposure
- temporary measures the parent can take to decrease lead exposure (wet cleaning areas with lead paint chips and dust; block access to lead hazards; handwashing before naps, meals, and after play; using only cold tap water for food and formula preparation, and flushing pipes each morning)
- developmental stage of the child and how it can contribute to lead exposure
- tips on nutrition that will reduce absorption of lead
- when the next venous blood lead test is due, and where venous blood lead tests can be obtained;
- the need to test siblings under 6 years of age and/or pregnant women in the household for lead poisoning
- the potential for the development of learning or behavior problems and the importance of reducing the sources of lead to decrease the duration of exposure

When case management services are provided to a child with lead poisoning, additional information specific to the child and the child’s environment is provided. This includes

- the role of the risk assessor and what will happen during and as a result of the environmental investigation for lead hazards
- the need for a thorough medical examination
- the importance of a developmental assessment
- signs in the child that may indicate need for support in learning and school settings

- chelation protocols if appropriate

Assessing the Child

Assessment of the child with lead poisoning and his/her family is a vital component of public health services. The assessment of the child encompasses both the child's physical and social environment, the growth and development of the child, the child's behavior, and the risk it may pose in the presence of lead hazards, as well as actual changes in the child due to lead toxicity. The capacity of the family to implement steps to decrease lead exposure is also a component of the assessment. With the findings of the assessment, interventions are planned to reduce exposure to lead and bring about a decrease in blood lead levels.

The importance of assessing the child with lead poisoning and his/her family in the home environment cannot be overstated. It allows observation of possible sources of lead exposure and the child's access to them, how the child plays and interacts with parents/caregivers, siblings, and strangers, language development, and parenting style. For children with screening BLLs of 10-19 $\mu\text{g}/\text{dL}$, a phone assessment, or assessment done during a public health office or WIC clinic visit may be adequate. But for children with prolonged lead levels in this range a home visit is optimal. For children with one venous BLL $\geq 20\mu\text{g}/\text{dL}$, or 2 venous BLLs $\geq 15\mu\text{g}/\text{dL}$ at least 90 days apart, case management is required with a minimum of two home visits recommended.

Assessment of the child includes the health status of the child, developmental assessment (Chapter 12), nutrition assessment (Chapter 11), and risk factors for lead exposure of the child and the environment. Another important part of this assessment is in determining the primary concerns of the family related to lead poisoning, and identifying other family issues that may influence the ability of the child to recover.

Assessment of Health Status

An assessment of the overall health of the child with lead poisoning provides a baseline to evaluate the effects of lead toxicity on growth, development, and learning, and to identify concurrent medical conditions that may influence the child's response and resiliency to lead poisoning. The assessment includes obtaining a thorough health history from parent/caregiver, and basic physical examination and developmental screening test.

Access to ongoing health care is important for children with lead poisoning to assure that venous blood lead tests and other laboratory tests are available, that appropriate medical interventions are initiated (see Chapter 10), and that long-term evaluation of the potential sequela of lead poisoning occurs within the context of overall health care (Chapters 10 and 12). If the child doesn't have a health care provider, this is an ideal time to assist the family in connecting with a provider/medical home.

Components of the assessment of overall health of a child with lead poisoning include:

- A detailed health history for the child. Any history of lead exposure/poisoning, including the date, results, screening site, and method (capillary or venous) of any

previous blood lead testing. WCLPPP can be contacted to obtain a complete history of BLLs drawn while the child was a Wisconsin resident; if the BLL meets the case opening criteria for WCLPPP, the blood lead history of the child will be included when the HD is notified of the case.

- A limited physical assessment. Done by the PHN, this determines the current health status, and the presence of any signs or symptoms that should be evaluated by a physician. This does not take the place of an age-appropriate physical examination done by a physician, and a referral should be made for the child to have it done. If lead poisoning was diagnosed as a result of blood drawn during a recent examination, the doctor can be contacted and copies of that evaluation obtained.
- Assessment of iron deficiency. Evaluate available laboratory blood tests, or contact the physician to request that the studies be done to determine if the child is iron deficient. Iron deficiency exacerbates lead absorption and lead toxicity on the central nervous system (see Chapters 7 and 10).

Developmental and Behavioral Assessment

Because the primary toxicity of lead poisoning in young children is to the development of the brain and central nervous system, a thorough developmental assessment must be documented. This assessment will determine a baseline by which future changes can be weighed, as well as identify the need for referrals to assist the child and family in addressing any delays as soon as possible. A developmental screening test is part of the limited physical assessment done by the nurse at a home visit. A referral should be made to the child's physician or a child development program such as Birth to 3 for a thorough assessment. It is important that the results of the assessment be documented, and that any delays noted are acted upon. Further information on developmental assessment and intervention can be found in Chapter 12. At the end of this chapter is a publication entitled "Great Beginnings: The First Years Last Forever from the Wisconsin Council on Families and Children on brain development. It provides a good description of the neurodevelopmental processes that are under way when a child is exposed to lead at a young age.

Nutrition Assessment

Nutrition can play a key role in protecting children from lead toxicity. Inadequate amounts of dietary iron and calcium increase the absorption of ingested lead. Sound eating patterns and schedules also contribute to the overall health of any child. For more information on the role nutrition plays in lead poisoning see Chapter 11. For children enrolled in WIC, lead poisoning is a risk factor in determining WIC eligibility. WIC nutritionists can provide nutrition counseling for children enrolled in their project.

Assess for the Presence of Risk Factors for Lead Exposure

Characteristics of the child or environment can increase the risk of lead poisoning. Each must be considered, and incorporated into the environmental and nursing management of the child's lead poisoning.

The developmental stage and habits of the child and family can contribute to lead exposure. The following factors may increase risk:

- A low hemoglobin or hematocrit (iron deficiency increases the absorption of lead).
- A history of pica, persistent chewing on varnished or painted surfaces, evidence of frequent hand-to-mouth activity (such as thumb sucking), or accidental ingestion of any non-edible substance.
- Exposure to imported cosmetics or home/traditional remedies that may contain lead.²
- The presence of anemia, growth failure, hyperactivity, lethargy, hearing loss, abdominal cramps, or periodic vomiting.
- Infrequent handwashing, especially after play, before eating and napping.
- Parents/guardians demonstrate limited understanding of normal childhood growth and development that can increase exposure to lead hazards.
- Periods of decreased adult supervision of the child in the presence of lead hazards

The PHN should observe and ask about risks for lead exposure in the child's environment. Lead based paint is the primary source of exposure for children. Take a walking tour of the interior and exterior of the residence with parent/caregiver to assess possible lead hazards. This is an essential and predictive element of risk assessment for children with lead exposure. The presence in the environment of one or more of the factors listed below may indicate a source of lead exposure:

- Child lives in a building where a lead hazard has already been found
- A sibling, housemate, or playmate has been diagnosed with lead poisoning.
- Child lives in or frequently visits a building constructed before 1950 (including previous addresses and current alternate addresses such as a babysitter, daycare, or home of a relative).
- Child lives in a pre-1978 building that has undergone renovation with the child living there.
- Painted or varnished surfaces are deteriorated: paint is chipping, peeling, flaking or located on a friction surface where dust is generated.
- The home is near heavy traffic areas, hazardous waste sites or solid waste incinerators, an active smelter, battery recycling plant or other industry likely to produce lead.
- Parents or other household members participate in a lead-related occupation or hobby³
- Home has vinyl mini/vertical blinds that test positive for lead and could produce lead dust upon deterioration.

If possible sources of lead hazards are identified, the parent/caregiver can be instructed on the use of a Lead Check Swab to verify the presence of lead.

² See Figure 4.5 for a list of imported cosmetics or traditional home remedies that may contain lead

³ Refer to Figures 4.2 and 4.3 for lists of lead-related occupations and hobbies.

Identifying Needed Actions and Services

From the assessment, a care plan is developed in which actions and services are identified that are needed by the child or family to treat lead poisoning. The family may need assistance in identifying and accessing community resources to address these needs. The case manager plays a coordinating and facilitating role in this area by referring families to sources that can provide assistance in meeting their needs.

Developing a Plan of Care

Based on the above assessments, a plan of care is developed with the family that describes steps needed to lower the EBLL, prevent re-exposure and identify services needed to treat the lead poisoning. The plan of care should consider and incorporate the level of knowledge, understanding, and learning style of the parent/caregiver about causes and effects of lead poisoning, medical management, and environmental lead hazard reduction.

The plan of care should:

- ✓ Link environmental, medical, and nursing management plans
- ✓ Identify measures to reduce risks for lead exposure
- ✓ Include appropriate nutritional, and behavioral measures to promote health and prevent lead exposure.
- ✓ Outline a schedule of visits/contacts with the PHN and health care provider, and for follow-up blood lead tests
- ✓ Include the family's goals and expectations
- ✓ Clearly state expected outcomes
- ✓ Clearly describe the responsibilities, actions, and expectations (i.e. contracting) of both the family and the case manager

The plan of care should incorporate the principles of holistic and individualized family care:

- ✓ Family members are active participants in developing and carrying out the plan
- ✓ Strengths, support systems, goals and challenges are identified with the family and used to develop the plan
- ✓ The culture, language, beliefs, traditions, learning style and financial resources of the family are recognized. Education materials and strategies should reflect family characteristics.
- ✓ Educational materials and instructions to the family are up-to-date, relevant to the child's age, BLL, and risk.

Ongoing review and revision of the plan of care is done with the family. Once the plan of care is developed, complete and send the "Case Report on Children with Elevated Blood Lead Levels (DPH4771A) to WCLPPP (form can be found at the end of this chapter).

Referrals to Community Resources

Discuss with parent/caregiver resources that can address childhood lead poisoning. Assure that the family understands the reason for referrals, to whom the child may be referred, and request permission to share medical information. Assure that the results of the referral are effective and acceptable to the family and provider.

- The need for the following referrals should be considered for all families of children with lead poisoning:
 - ✓ Services to provide a thorough developmental assessment (if needed), and/or provide treatment in areas where developmental delays have been noted (such as Infant Stimulation, Birth to 3, HeadStart or early childhood programs.)
 - ✓ Evaluation and follow-up services for any difficulties experienced in a structured learning setting (pre-school or school).
 - ✓ Nutrition counseling to address dietary components that protect from lead poisoning (refer income eligible families to WIC).
 - ✓ Financial assistance from local housing or weatherization agencies for lead hazard reduction work on the property.
 - ✓ Ongoing source of affordable primary health care
 - ✓ Blood lead testing for pregnant women and other children <6 years of age in the household who share exposure to lead hazards.
- Assure that appropriate referrals are made. Document if the desired outcome of the referrals was met to the family's satisfaction and according to professional standards.
- Support the family in securing needed resources by addressing barriers such as transportation, childcare, translation services, access to primary health care, access to affordable and safe housing.

In addition to referrals for the family, the health care provider caring for the child may be unfamiliar with treatment protocols. The health care provider can be referred to Dr. Margaret Layde, Downtown Health Center, Milwaukee (414) 277-8900 if a consultation with a practitioner experienced in treating children with lead poisoning is needed.

Advocating for the Child and Family

Advocating for the child with lead poisoning involves not only assuring that the needs of the child are met, but also providing information to parties who can assist the child's recovery. These parties may have little or no information or experience with lead poisoning. The case manager supports the family in explaining complex issues of lead poisoning to medical, school, and housing personnel.

- Assure that the public health assessments (lead investigation and nursing assessment) and the implications for medical management are communicated to the health care provider.
- Assist family in explaining the effects of lead poisoning on cognitive development, behavior, and learning to school personnel.

- Encourage and assist the family in accessing early childhood programs for their child as appropriate
- Advocate with health care providers to assure that drug treatment and medical management is consistent with established standards and recommendations
- Advocate for the family to assure that the child is in a lead-safe environment during and after chelation. This may include assisting the family to find alternative housing arrangements, delay discharge, or encouraging the physician to suspend or postpone outpatient chelation until a lead safe environment is secured.

Coordinating Services

A diagnosis of lead poisoning in a child may plunge the family into a whirlwind of activity, worry, guilt, expense, frustration, and loss of control. The case manager serves as an anchor during this experience, providing emotional support, assuring effective communication between those participating in the treatment of lead poisoning, and referring and coordinating services identified by and for the family.

Supporting the Family

Families faced with a diagnosis of lead poisoning of their child may require ongoing reassurance. This is important in supporting and meeting the needs of the child who is lead poisoned, especially when no overt signs and symptoms are evident. Parents often feel guilt about having caused the lead exposure. They may not have been knowledgeable about childhood lead poisoning before their child was poisoned. They may also be uncertain as to what they can do to help their child.

The case manager should:

- Continue to assess the family's understanding and response to the diagnosis of lead poisoning, and the implications lead toxicity may have on the child's learning abilities, behavior, and future.
- Provide support to the parent or guardian in monitoring and implementing medical, environmental, and other strategies to treat lead poisoning.
- Empower the family to assume responsibility for actions within their control to lower the blood lead level.

Communication Among Multi-disciplinary Team Members

The case manager performs the role of prime communicator between the multiple professions that are providing services to the child and family. Several strategies are suggested to keep the entire team of providers current on the status of the child, the environment, and the family. Not only does this facilitate the work of all involved with the family, but it keeps the child as the focus, preventing the services from becoming categorical or overlapping.

- ✓ Exchange information regularly with the child's primary health care provider. Make sure that he/she is aware that public health services are being provided to the

child and family, and what those services include. Request information from the physician, such as copies of the physical assessment of the child. A sample form that can be used when contacting the physician can be found in Chapter 15.

- ✓ Convene case conferences on lead poisoned children being served by the HD. Include the risk assessor, WIC nutritionist, early childhood program staff, social services, and any others that are providing services to the child and/or family. Discussion and problem solving should revolve around the outcomes defined by the plan of care, (medical, environmental, nursing, nutritional, developmental, etc), and any ongoing issues and concerns.

Evaluation of Care

With an eye on attaining the outcomes described earlier in this chapter, the child's status and the plan of care should be evaluated. Evaluation is ongoing during case management and includes monitoring the child's response to treatment, as well as progress towards the desired outcomes.

Monitoring Health Status

The child's response to environmental and medical management provided to treat lead poisoning can be monitored by tracking the following indicators of health status:

- Timely blood lead follow-up testing (see Chapter 7). If being chelated, observe for a rebound effect, any evidence of re-exposure, or side effects of chelating agents. (see Chapter 10)
- Evaluation of iron status. Have the appropriate tests done to determine the etiology of iron deficiency and corrective actions taken (Chapter 7). Iron deficiency often co-exists with lead poisoning and can potentiate central nervous system effects.
- Erythrocyte protoporphyrin (EP) in conjunction with BLLs to assist in determining the effectiveness of interventions and evaluate if re-exposure has occurred (see Chapter 7).

In addition to monitoring indicators of the child's response to treatment, the case manager should also assure that environmental investigation occurs, and lead hazard reduction orders are effectively completed in the shortest time possible to limit the child's exposure.

Measuring Outcomes

Evaluation of the plan of care and progress towards desired outcomes should be ongoing, and the plan modified as needed. It is important to determine if the outcomes of the plan of care were achieved to the satisfaction of both the client and the case manager. Expected outcomes, along with specific measures that can indicate progress towards the outcome, are listed below:

- The child's blood lead level is reduced
 - ✓ The pattern of BLL results indicate that the level is stabilizing and/or decreasing

- ✓ The EP results indicate that no re-exposure is occurring
- The child is living in a lead safe environment
 - ✓ Lead hazards have been identified and exposure has been controlled or eliminated
- The child with lead poisoning is achieving his/her optimal level of functioning
 - ✓ Child is enrolled in programs to provide supportive services as needed for identified delays in behavior, learning, or motor skills.
- The parent/caregiver has adequate knowledge of prevention and management of lead toxicity
 - ✓ Parent/caregiver can identify behaviors that place children at risk
 - ✓ Parent/caregiver can identify sources of lead hazards in the home and other environments
 - ✓ Parent/caregiver can implement basic health promotion actions to decrease BLLs and exposure (e.g., handwashing, nutrition, wet cleaning)
 - ✓ Parent/caregiver takes actions to create and maintain lead-safe environments to reduce or eliminate exposure
 - ✓ Parent/caregiver participates in the development and implementation of the medical, nursing and environmental treatment plans

Closing the Case

It is important to note that the child's case follow-up and the property investigation follow-up are two separate components in the management of lead poisoning. The public health professional should determine if the closure criteria for the child or property have been met individually. However, the case record on the child should not be closed until the lead hazard investigation of the property is completed, including all lead hazard reduction work and clearance testing.

The Centers for Disease Control and Prevention identifies the criteria to be met before routine blood lead testing of a child with lead poisoning can be decreased. The criteria are:

- ✓ The BLL has remained $<15\mu\text{g/dL}$ for 6 months
- ✓ Lead hazards have been controlled or eliminated
- ✓ There are no new lead exposures

After these criteria are met, BLLs should be obtained every 3 months until the child reaches 36 months of age, and then as needed. The WCLPPP has adopted these CDC criteria for use in determining when to close a child's case, although there may be other family or child characteristics that make continued monitoring appropriate. Child case records may also be closed if the family moves (a referral to the receiving health department should be made), if they refuse further intervention, or if they can no longer be located. When closing a case, the case manager should encourage families to continue to have the child tested every 3 months until age 36 months, and to monitor and support this follow-up.

For children with one venous BLL of $\geq 20\mu\text{g/dL}$ or 2 venous BLLs of $15\text{--}19\mu\text{g/dL}$ at least 90 days apart, a Case Closure Report on Children With Elevated Blood Lead Levels (DPH4771B) is to be completed and sent to WCLPPP when the child case is closed. Copies of this form can be found at the end of this chapter.

Further Resources

Case managers can refer to the CDC documents and other federal and state lead poisoning prevention and control documents, including state statutes and administrative rules, to assure the continued delivery of high quality public health nursing services to the public. For a list of these resources, see Chapter 14.

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Revised 5/2/2003

Great Beginnings: The *First Years Last Forever*

As we approach the birth of a new millennium, with all that
Fresh beginnings imply, we are filled with hope and anticipation.
And nowhere is the future more celebrated than in the
Genuinely precious gift of each new child.

A society is measured not only by its ability to overcome obstacles,
but by its ability to nurture opportunities.

And it all begins with babies.

Johnson & Johnson

It all begins with babies...and their brains. The first three years are a critical period in the development of every child. The experiences of that child will influence the way in which the brain grows – the way in which the brain is wired. For example, if a baby hears a lot of rich, descriptive words, s/he is likely to be much more able to think conceptually than children whose caregivers do not talk with them very often.

Why are the first three years so important...because the brain is NOT fully developed at birth. However, by age three, 85% of the core structures are in place. So an infant or toddler who sees few pictures, few colors, hears less conversation, feels little affection and loving touch, actually has a brain that is 20-30% *smaller* than a child who is loved, cuddled, and nourished. A warm, nurturing environment with consistent loving adults and caregivers will give a child the foundation for a promising future. A hostile or sterile living environment coupled with inattentive, emotionally unpredictable, or changing caregivers will leave a child with diminished potential.

The impact of the environment is dramatic and specific, not merely influencing the general direction of development, but specifically affecting how the intricate circuitry of the human brain is 'wired'.

How the Brain Develops

The brain grows in sequential fashion, from bottom (brainstem) to top (cortex), or from the least complex part (brainstem) to the more complex area (cortex).

Brainstem – at the base of the skull

- ❑ Controls the most basic life activities, including heart rate, blood pressure, & body temperature.

Cerebellum or midbrain – near the base of the skull behind the brainstem

- ❑ Controls movement, appetite, & sleep.

Limbic system – inner, central portion of the brain

- ❑ Controls emotional reactivity, attachment, affect regulation, long-term memory.

Cortex – top layer of the brain, about the depth of two dimes placed on top of each other

- ❑ Controls logical thinking, reasoning, abstract thought, emotional mediation.

Take Care! Neurons at Work

While many cell types make up brain mass, the neuron is the brain cell which mediates the activities that we associate with brain function – thinking, feeling, seeing, etc. We are born with roughly 100 billion neurons which connect with one another through synapses to form networks that connect to form systems. The systems work together to allow specific activities, such as vision, to occur. For instance, in the region of the cortex that controls vision (occipital lobe), there are a number of “visual maps” or systems of neurons that respond to different components of sight, i.e., color, form, motion. Yet, the individual sees a synthesized “picture.” What happens to the child, both prenatally and during the first years of life will determine how these brain cells move from the more primitive, or lower, areas of the brain up to the limbic and cortical regions. The environment also inhibits or reinforces the connections (synapses) that occur between brain cells.

Neurons on the Move

Because the different systems in the child’s brain develop at different times, neuroscientists have determined that specific parts of the brain require environmental stimulation during specific times in a child’s life. If a child is deprived of visual stimulation during the first few months of life, that child will have permanent visual impairment. The critical windows are associated with the migration and differentiation (taking on a specific, rather than a general, function) of neurons. As Dr. Felton Earls states:

In complex organisms, neurons must travel from the proliferative area in which they are generated to distant zones where they differentiate and establish permanent connections with other neurons...These events occur at specific times in the developmental cascade and a missed “opportunity” cannot be compensated for at a later time as the conditions have changed and the developmental potential has become constrained or limited by subsequent events.

Knowing that the different systems develop at different times and that environmental stimulation is necessary for normal development, tells us two important things:

1. A child must receive the appropriate “signals” from the environment - they must hear language to learn language; they must be able to see in order to develop vision; they must be cuddled, loved, and touched to understand human connection.
2. If environmental cues are missing during critical times of development, the parts of the brain regulating these activities do not develop appropriately.

What about the Environmental Cues? What Happens?

Appropriate environmental stimuli, at the appropriate times, strengthen the neuronal synapses and when the stimuli are repeated they reinforce the synapses in a use-dependent fashion.

❑ Vision – in the occipital lobe, there is a spurt in neuronal synapse formation between months two and four that peaks at the eighth month when a single neuron may connect to as many as 15,000 other neurons depending upon the visual experiences of the child. If a child is born with a congenital cataract, it must be removed early in life; age two is too late – the neuronal connections between the eye and the brain will have failed to form.

- ❑ Language – by six months of age, the auditory map (temporal lobe) in a child from a Spanish-speaking family looks different than the auditory map of a child in an English-speaking family. Research has shown that children who are language-deprived are less able to think conceptually at age four than children who have a rich language experience (hearing a lot of descriptive words spoken with an encouraging, loving voice).
- ❑ Touch – children, deprived of touch, do not exhibit normal body or brain development; attachment behavior is affected because the part of the brain (parietal lobe) involved in attachment does not develop normally; the “wiring” is less dense because of sensory deprivation.

Such a person is literally lacking some brain organization that would allow him to actually make strong connections to other human beings. Remember the orphans in Romania? They're a classic example of children who, by virtue of not being touched and held and having their eyes gazed into, didn't get the somatosensory bath.

Dr. Bruce Perry

When Things Go Wrong

Trauma and abuse can cause significant damage to the developing brains of young children. Increased levels of cortisol wash over the brain, causing parts to be 20-30% smaller than in normal brains. In addition, certain brain systems appear to be sensitized by repeated traumatic experiences (use-dependent phenomenon), so that these children may exhibit hyperactivity, anxiety, and/or impulsive behavior. Dr. Megan Gunnar, University of Minnesota, states, “Kids from high stress environments [have] problems in attention regulation and self-control.”

Public Policy Implications

The brain holds the key to our highest potential as human beings. If programs and policies can increase the number of children who will become intelligent, empathetic, productive adults and decrease the number of children who will require special education, mental health, child protective, and juvenile justice services, then government ought to ensure those programs and policies.

- ❑ The first provider for each child is the parent(s). Parenting resources such as home visiting programs should be accessible statewide.
- ❑ Programs should be accessible statewide
- ❑ Demand and support high standards and adequate funding for child care, foster care, and child protective services.
- ❑ Integrate key principles of child development and caregiving into public education. We require more formal education for driving a car than rearing a child.

Source: Wisconsin Council on Families and Children, 2000.